

## Transportation Safety and Mobility

### FEBRUARY 2015

**Project Title:**

Field Test the Effectiveness of Adaptive Traffic Control for Arterial Signal Management

**Task Number:** 2272

**Start Date:** October 18, 2011

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**Product Category:** Evaluation of new commercial products to determine if they meet Caltrans' needs; new or improved tool

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## Comparing Adaptive and Time-of-Day Traffic Control Systems

*Adaptive signal coordination can reduce congestion using real-time traffic information*

### WHAT WAS THE NEED?

Adaptive traffic control systems adjust traffic signals—cycle length, green times, offsets—based on real-time traffic conditions, easing traffic congestion and optimizing arterials. They can also respond to unexpected or unplanned events, such as incidents and adverse weather. To explore its use on state highways and arterials, previous tasks had simulated several adaptive signal control algorithms with the results showing improved traffic flow and reduced side-street delay over traditional time-of-day (TOD) controls that use preprogrammed, daily signal schedules. The next step was to compare the performance of an adaptive signal control system under real-world conditions to find an effective strategy for arterial highways and corridor management.

### WHAT WAS OUR GOAL?

The goal was to compare the performance of an adaptive traffic control system to a fixed-cycle, time-of-day coordination scheme using simulations and field tests.



*Bluetooth detector in portable case*



*Mounting a Bluetooth detector on the crosswalk flashing beacon standard*

## WHAT DID WE DO?

The Los Angeles area uses the Adaptive Traffic Control System (ATCS) to operate a nine-intersection arterial on Highway 1. To compare the performance of this system during peak commute times and the less-congested midday period, Caltrans, in partnership with the University of California, Berkeley Partners for Advanced Transportation Technology program, designed six TOD signal coordination plans for each direction. The three TOD-230 plans had cycle lengths comparable to those of ATCS, constrained to 230 seconds during the morning and afternoon peak periods. The three TOD-Optimized plans used optimized cycle lengths as determined by Synchro traffic simulation software. Using Bluetooth detectors, the researchers collected about 5,000 individual travel times in each direction. They also monitored side-street queue lengths to determine if those splits had sufficient time.

## WHAT WAS THE OUTCOME?

All three strategies performed similarly during midday when traffic volumes and congestion were relatively low. ATCS demonstrated the best overall performance, but the TOD-230 PM peak plan did best in the northbound direction, with an average travel time savings of 2.4 minutes over ATCS and 5.5 minutes over the TOD-Optimized plan. In the southbound direction, ATCS outperformed both fixed-time plans in the AM peak period, with an average arterial travel time savings of 3 minutes over the TOD-230 plan.

ATCS had some inefficiencies during oversaturated traffic conditions due to operating each intersection independently as opposed to part of the entire arterial. For example, during the afternoon peak, the primary bottleneck was the intersection of Sunset Blvd., where ATCS gave up to 20% more green time than necessary to the side street, causing delays for the mainline travelers. Consequently, this condition often resulted in giving too much green time to the mainline at the intersection upstream of Sunset Blvd., which provided no benefit to the drivers heading toward the bottleneck.

## WHAT IS THE BENEFIT?

Poor traffic signal timing contributes to traffic congestion and delay. Adaptive signal control technology adjusts the timing of lights to accommodate changing traffic patterns, smoothing traffic flow, shortening travel times, and reducing fuel usage and air pollutants caused by idling vehicles. Adaptive signal control can result in arterial travel time performance similar to or better than traditional TOD control, but with less time and effort spent by signal operations personnel making timing adjustments.

## LEARN MORE

To view the complete report:  
[www.dot.ca.gov/research/researchreports/reports/2014/final\\_report\\_task\\_2272.pdf](http://www.dot.ca.gov/research/researchreports/reports/2014/final_report_task_2272.pdf)

A. Northbound Direction				
CONTROL STRATEGY	TIME PERIOD			
	AM	MIDDAY	PM	
ATCS	2	3	2	
TOD-230	3*	1	1	
TOD-OPTIMIZED	1	2	3*	

  

B. Southbound Direction				
CONTROL STRATEGY	TIME PERIOD			
	AM	MIDDAY	PM	
ATCS	1*	2	2	
TOD-230	3	1	1	
TOD-OPTIMIZED	2	3	3*	

\* Differences in Performance are Statistically Significant

Ranking of control strategies based on travel time data, with 1 being best



Study area: Nine intersections from California Incline to Topanga Canyon Blvd.